

UPDATED 8/20/07

QUALITY ASSURANCE PROJECT PLAN

FOR A

**SITE CHARACTERIZATION AT THE
HERCULANEUM LEAD SMELTER**

**HERCULANEUM, MISSOURI
CERCLIS ID NO.: MOD006266373**

Prepared For:

U.S. Environmental Protection Agency Region VII
Superfund Division
901 North 5th Street
Kansas City, Kansas 66101

Prepared By:

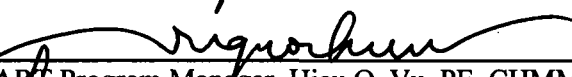
USEPA Region VII Superfund Technical Assessment and Response Team (START) 2

September 10, 2001


APPROVED BY:


START Project Manager, Ryan Schuler

9/11/01
Date


START Program Manager, Hieu Q. Vu, PE, CHMM

9/11/01
Date


EPA Project Manager, Superfund Division, Joe Davis

9-11-01
Date


EPA Superfund Quality Assurance Coordinator, Bob Dona

9/12/01
Date

40338835



Superfund

G9011/010027.00

TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
1.0 PROJECT MANAGEMENT	1
1.1 DISTRIBUTION LIST	1
1.2 PROJECT/TASK ORGANIZATION/SCOPE OF WORK	1
1.3 PROBLEM DEFINITION/BACKGROUND/SITE DESCRIPTION	2
1.4 PROJECT/TASK DESCRIPTION	4
1.5 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA	5
1.6 SPECIAL TRAINING REQUIREMENTS/CERTIFICATION	6
1.7 DOCUMENTATION AND RECORDS	6
2.0 MEASUREMENT/DATA ACQUISITION	7
2.1 SAMPLING PROCESS DESIGN	7
2.2 SAMPLING METHODS REQUIREMENTS	9
2.3 SAMPLE HANDLING AND CUSTODY REQUIREMENTS	10
2.4 ANALYTICAL METHODS REQUIREMENTS	11
2.5 QUALITY CONTROL REQUIREMENTS	11
2.6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS	12
2.7 INSTRUMENT CALIBRATION AND FREQUENCY	12
2.8 INSPECTION/ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND CONSUMABLES	12
2.9 DATA ACQUISITION REQUIREMENTS	13
2.10 DATA MANAGEMENT	13
3.0 ASSESSMENT/OVERSIGHT	13
3.1 ASSESSMENTS AND RESPONSE ACTIONS	13
3.2 REPORTS TO MANAGEMENT	13
4.0 DATA VALIDATION AND USABILITY	14
4.1 DATA REVIEW, VALIDATION, AND VERIFICATION REQUIREMENTS	14
4.2 VALIDATION AND VERIFICATION METHODS	14
4.3 RECONCILIATION WITH USER REQUIREMENTS	14

ATTACHMENTS

- A Figure 1: Site Location Map
- B Figure 2: Aerial Photo
- C Figure 3: Sampling Map

1.0 PROJECT MANAGEMENT

1.1 DISTRIBUTION LIST

Region VII EPA

Joe Davis, USEPA Project Manager
Bob Dona, USEPA SuperFund Quality Assurance
Coordinator

Region VII START

Ryan Schuler, START Project Manager
Hieu Q. Vu, START Program Manager
Ted Faile, START Quality Assurance Manager

1.2 PROJECT/TASK ORGANIZATION/SCOPE OF WORK

Ryan Schuler, of the U.S. Environmental Protection Agency (USEPA) Region VII Superfund Technical Assessment and Response Team (START), will serve as the START Project Manager for the activities described in this Quality Assurance Project Plan (QAPP) to be conducted at the Herculaneum Lead Smelter Site in Herculaneum, Missouri. He will be responsible for overall coordination of site activities, ensuring implementation of the QAPP, and providing periodic updates to the client concerning the status of the project, as needed. Joe Davis will be the USEPA Project Manager for this activity.

Eight to ten START members will comprise the field/sampling team. The team will be responsible for assisting EPA with surveying activities, obtaining access to sampling properties, acquisition and calibration of sampling equipment, sample collection, field screening, documentation of residential property conditions and field activities, and coordination of laboratory analyses. The START Quality Assurance (QA) Manager will provide technical assistance, as needed, to ensure that necessary QA issues are adequately addressed.

This QAPP was prepared to address site characterization to determine the extent of soil contamination caused by operations at the Herculaneum Lead Smelter (HLS) site in Herculaneum, Missouri. In addition, air monitoring stations will be established to document fugitive releases of airborne contaminants. The scope of work includes obtaining property access, surveying/marketing sampling cells at each property, collection of surface soil samples for field screening and laboratory analyses, and collection of ambient air samples at several locations near the HLS site.

Although an attempt will be made to adhere to this QAPP as much as possible, the proposed activities may be altered in the field if warranted by site-specific conditions and/or unforeseen hindrances that prevent any aspect of this QAPP from being implemented in a feasible manner. Such deviations will be recorded in the site logbook as necessary. This QAPP will be available to the field team(s) at all times during sampling activities to serve as a key reference for the proposed activities described herein.

1.3 PROBLEM DEFINITION/BACKGROUND/SITE DESCRIPTION

This QAPP was prepared by the Tetra Tech START to address imminent and long-term concerns that could impact human health and/or the environment at the HLS site (site), where metals-contaminated soils (predominantly lead, cadmium and zinc) have been identified during previous sampling activities.

The HLS site is located at 881 Main Street in Herculaneum, Missouri, about 25 miles south of the St. Louis metropolitan area (see Attachment A - Figure 1: Site Location Map). The site property is approximately 52 acres in size. An approximately 24-acre slag disposal pile is located south of the smelter in a horseshoe bend of Joachim Creek. The slag pile is located in the floodplain of Joachim Creek, in an area classified as a wetland. The smelter site is bordered on the east by the Mississippi River and on the north and west by residential areas. South of the smelter is the slag pile and wetland area. The slag pile is bordered to the east, west, and south by Joachim Creek, and to the north by residential areas and the smelter facility (see Attachment B - Figure 2: Aerial Photography). The slag pile and most of the smelter facility are located in Jefferson County, Section 29, T. 41 N., R.6 E., although the northern portion of the facility extends into Section 20. Geographic coordinates of the site are 38 15' 19.0" north latitude and 90 22' 56.7" west longitude.

The site is an active lead smelter, the largest of its kind in the United States. HLS began operations in 1892 as part of the St. Joseph Lead Company. In 1986, it became part of the newly formed Doe Run Company (Doe Run), a joint venture of the Fluor Corporation and the Homestake Mining Company. In 1990, the Fluor Corporation became the sole owner of Doe Run. The site consists of three main areas: (1) the smelter plant, located on the east side of Main Street; (2) the slag storage pile; and (3) office buildings on the west side of Main Street.

The following major processes occur at the HLS site: (1) sintering, smelting, and refining of lead ore;

(2) sulfuric acid production from waste sulfur-containing gases generated by the sintering operation; and (3) wastewater treatment. The smelting operation generates a molten slag, 20 percent of which is sent to a slag storage pile as waste. The slag pile occupies approximately 24 acres in the floodplain of Joachim Creek, and is up to 40 feet tall in some sections. In 1993, during a major flood event, water reached several feet up the sides of the slag pile. The site also generates stack air emissions from the smelter and fugitive air emissions from various operations (MDNR, 1999).

Several investigations have been conducted at the site, including a Preliminary Assessment/ Screening Site Inspection by the EPA in 1980, a multimedia compliance inspection by the EPA in 1995, a Preliminary Ecological Risk Assessment for Fish and Wildlife Habitats by the U.S. Fish and Wildlife Service (USFWS) in 1998, and a Preliminary Assessment by the Missouri Department of Natural Resources (MDNR) in 1998 and 1999. In addition to these state and federal lead investigations, the facility has collected and submitted to the state a large quantity of environmental data pursuant to Missouri's site-specific State Implementation Plan (SIP) established under the Clean Air Act (CAA), National Pollutant Discharge Elimination System (NPDES) permit, Metallic Minerals Waste Management Act permit, and voluntary soil cleanup efforts in the surrounding Herculaneum community.

Based on previous investigations, primary metal contaminants in the slag pile include arsenic, cadmium, copper, lead, nickel, and zinc. The slag pile has been partially inundated by flood waters in the past. The USFWS identified significant concentrations of lead, cadmium, and zinc in floodplain soils; significant concentrations of lead and zinc in river sediments; and significant zinc concentrations in surface water samples collected from drainage ditches on the Joachim Creek floodplain.

Stack and fugitive emissions from the site, and fall-out from these emissions, have resulted in releases of lead, cadmium, and sulfur dioxide to the air and soil. Since 1980, the smelter's emissions have been regulated under general and site-specific regulation established in the SIP. Lead emissions at one air monitoring station near the site have consistently been above the 1.5 microgram per cubic meter ($\mu\text{g}/\text{m}^3$) National Ambient Air Quality Standard (NAAQS), since it was installed in 1992. Due to the continued noncompliance with the NAAQS standard, new SIP regulations are being developed by the site and MDNR.

Soil sampling has shown lead levels as high as 12,800 parts per million (ppm) in the surface soils of homes surrounding the smelter. A 1992 Jefferson County Health Department study identified 13 homes near the site where children had lead levels greater than 15 micrograms per decaliter (g/dl). Twelve of these 13 homes had lead levels in the soil ranging from 1,000 to 3,500 ppm, and one had lead levels in the soil up to 999 ppm. Thirteen out of 21 birds tested as part of the USFWS study showed clinical or subclinical lead poisoning based on liver analysis. Fish and tissue samples collected during this study had lead concentrations up to 7.5 ppm. Under a groundwater monitoring program conducted at the site since 1980, lead and cadmium concentrations in the groundwater periodically have been found above the respective maximum contaminant levels (MCLs) established under the Safe Drinking Water Act. The MCLs for lead and cadmium are 15 parts per billion (ppb) and 5 ppb, respectively.

In August of 2001, EPA was notified by a Herculaneum citizen of a grey powdery substance on the roads in the town. Further investigation identified the substance containing lead at 300,000 ppm or 30%. Additional field screening identified the trucks delivering lead concentrate to the Doe Run Smelter as the likely source of the material along the haul routes in the town.

1.4 PROJECT/TASK DESCRIPTION

The activities described in this QAPP will address the following:

- A. The extent of soil contamination in residential yards, day-care facilities, areas in schoolyards frequented by children, parks, and all other child high-use areas affected by the HLS operations located east of and adjacent to U. S. Highway 61 and north of Joachim Creek in the township of Herculaneum. In addition, all residential yards and child high-use areas adjacent to or north of Old Route 61 Highway between the Joachim Creek overpass and U.S. Highway 61 shall be characterized. This includes all residential lots owned by the Doe Run Company and vacant residential lots.
- B. If the results of the site characterization along haul routes conducted in item A above indicate that high levels of surface soil contamination exists beyond the boundaries specified, sampling will be conducted to delineate the extent of this contamination in residential yards, day-care facilities, areas in schoolyards frequented by children, parks, and all other high use

areas affected by the HLS operations.

1.5 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

The QA objective for this project is to provide valid data of known and documented quality. Specific Data Quality Objectives (DQO's) are discussed in terms of accuracy, precision, completeness, representativeness, and comparability.

For this project, accuracy is defined as the ratio, expressed as a percentage, of a measured value to a true or reference value. The measurement process of a contaminant concentration includes separate field and laboratory measurements. Errors are associated with each of these two types of measurements. These errors will be quantified and expressed as a measure of accuracy. The analytical component of accuracy will be expressed as Percent Recovery based on the analysis of lab-prepared spike samples and Performance Evaluation (PE) audit samples.

Precision for this project is defined as a measure of agreement among individual measurements of the same property and will be expressed via duplicate samples. The overall precision is assessed by collection of duplicate or collocated samples. Approximately 10% of duplicate/collocated samples is anticipated.

Data completeness will be expressed as the percentage of data generated that is considered valid. A completeness goal of 100% will be applied to this project; however, if that goal is not met, site decisions may still be made based on the remaining data. No specific critical samples have been identified for the project.

Representativeness of collected samples is facilitated by establishing and following criteria and procedures identified in this QAPP.

Data comparability is achieved by requiring all data generated for the project be reported in common units. The following table lists the various types of data that will be generated and the specific reporting units.

SPECIFIC DATA REPORTING UNITS	
PARAMETER	UNIT
Metals in Soil by X-ray Fluorescence Spectrometer (XRF)	ppm
Metals in Soil by Laboratory Analysis	milligrams per kilogram (mg/kg)
Metals in Air	micrograms per cubic meter ($\mu\text{g}/\text{m}^3$)
Sampled Air Volume at Standard Temperature and Pressure (STP)	cubic meters at STP (m^3 STP)
Sampling Flowrate at STP	cubic meters per minute at STP (m^3/min STP)
Wind Speed	miles per hour (mph)
Wind Direction (Field Report)	degrees on an azimuth compass
Temperature	degrees Fahrenheit (F)
Barometric Pressure (not corrected to sea level)	millimeters of mercury (mm Hg)
Time	military time (00:00 - 24:00)
Date	month/day/year

1.6 SPECIAL TRAINING REQUIREMENTS/CERTIFICATION

All site personnel will be required to have completed a basic 40-hour health and safety (Hazardous Waste Operations and Emergency Response [HAZWOPER]) training course and annual refreshers. Familiarization with the Niton™ XRF and its operating procedures will also be necessary for the START members.

1.7 DOCUMENTATION AND RECORDS

START personnel will maintain a field logbook to record all pertinent activities associated with the sampling events. Appropriate documentation pertaining to photographs taken by START will also be recorded in the field logbook. Information pertaining to all samples (i.e., sampling dates/times, locations, etc.) collected during this event will be recorded on sample field sheets generated by START. Labels generated by START will be affixed to sample containers, identifying sample numbers, dates collected, and requested analyses. Chain of custody records will be completed/maintained for all samples from the time of their collection until they are submitted to the laboratory for analysis.

A health and safety plan will be prepared by START prior to the field activities that will address site-specific hazards. The health and safety plan will be reviewed and signed by all field personnel prior to field work, indicating that they understand the plan and its requirements. Copies of the plan will be available to all personnel throughout the sampling activities.

2.0 MEASUREMENT/DATA ACQUISITION

2.1 SAMPLING PROCESS DESIGN

The proposed sampling scheme for this project will be in accordance with the Removal Program Representative Sampling Guidance, Volume 1: Soil, OSWER Directive 9360.4-10, November 1991, and judgmental (based on the best professional judgement of the sampling team). The sampling design proposed in the following paragraphs has been selected to identify the extent of soil contamination at the site. The proposed number of samples is a balance between cost and coverage and represents a reasonable attempt to meet the study objectives while staying within the budget constraints of a typical site investigation.

The characterization sampling will be conducted in a priority hierarchy as follows:

1. Residential yards where a known child under 7 years old resides.
2. Residential yards along the primary and secondary concentrate haul routes.
3. Child high use areas.

At a minimum, residential properties located in the previously identified area will have four quadrants established around the home, which will radiate out 50 feet from each side of the home. In each quadrant, a nine-aliquot composite sample will be collected from the upper 1 inch of soil and screened with a Niton™ XRF. Therefore, a minimum of 4 four samples will be collected from each residential property. Soil samples will not be collected from within 3 feet of the residential dwellings to reduce the potential lead-based paint contribution to soil-lead concentrations. In addition, multi-aliquot surface soil samples will be taken at the drip line of each structure where a child under 6 years old with elevated blood lead is known to reside. Multi-aliquot surface soil samples will also be collected from any play areas, gardens, sand piles, unpaved driveways, and other areas appearing to be frequented by children. The number of aliquots for these areas will be dependent upon size, but, in general, will follow the

aliquot density used for the quadrants.

A 9-aliquot soil sample will be collected from the five-foot section of residential yards and high child use areas adjacent to roads used as haul routes by the Doe Run Company and within the first 50 yards of the streets intersecting with those haul routes.

In addition to soil sampling at residential properties, indoor dust samples will be collected at residential homes which meet the one of the following criteria: 1) homes which have a child less than 6 years of age; and 2) homes which have an XRF screening concentration of greater than 10,000 ppm from any area of the yard.

For locations where there are no residences, a center point, depicting a possible future building site, will be established and flagged. From the center point, four quadrants will be established, which will radiate out 100 feet in each compass direction, and the aforementioned sampling protocols will be completed (e.g. collecting a nine-aliquot composite from each quadrant).

If the results of the screening characterization conducted indicate that surface soil contamination exists (i.e., lead concentrations greater than 400 ppm) beyond the specified limits, further sampling will be conducted on properties beyond the defined sampling.

In addition to soil sampling, four to five ambient air sampling apparatus will be established at several locations near the smelter to determine the potential impact of transporting lead materials from and to the smelter. Specific monitoring locations will be based on field judgment. The monitoring locations will include high traffic and low traffic areas, in order to study any differences. The sampling apparatus will include Hi-Vol and PM-10 Hi-Vol air monitoring instruments. The air monitoring instruments will be placed on the ground. At least one Hi-Vol and one PM-10 Hi-Vol will be collocated at one location.

A summary of anticipated samples to be collected for this project is provided in the following table. The exact number will depend on field screening results, as previously described. Approximately 10 percent of all screening samples will be collected for laboratory confirmation analysis.

Matrix	Number of Samples		Laboratory Analyses ¹
	Field Screening (Lead)	Laboratory	
Soil	4000	400	Lead, cadmium, arsenic, zinc, nickel
Dust	NA	250	Lead, cadmium, arsenic, zinc, nickel
Air	NA	200	Lead, cadmium, arsenic, zinc, nickel

NA = Not Applicable

¹ See Section 2.4 for details pertaining to analyses.

2.2 SAMPLING METHODS REQUIREMENTS

Soil samples will be collected following the EPA Region 7 SOP #2231.12A: ERT #2012; "Soil Sampling". Confirmation soil samples will be collected with a clean, dedicated stainless steel spoon and homogenized in a clean, dedicated aluminum pie pan. The samples will be screened with the XRF after homogenizing the soil, and three consecutive XRF readings will be collected. The three homogenized XRF readings will be recorded on a field sheet. Screening samples using the XRF will follow EPA Region 7 SOP # 4231.707A. The location of the XRF readings (as well as confirmation sample location, if necessary) will also be recorded on each field sheet. Confirmation samples will be transferred directly into the appropriate container for analysis. The samples will be submitted to a subcontracted laboratory.

Indoor dust sampling will be conducted in accordance with EPA Region 7 SOP #4231.11A with a minor modification to include the use of a hand-held electric vacuum sweeper. A dedicated filter will be used for each sample. The dust sample will be collected from an adequate area to provide a minimum of 5 grams of weight. The sampling area will include high traffic areas, children bedrooms, and/or undisturbed areas. Pertinent sampling information will be documented on field sheets. The dust sample will be transferred directly into a dedicated ziplock bag and labeled for laboratory analysis.

All ambient air sampling will be accomplished using Hi-Vol and PM-10 Hi-Vol Air Samplers (manufactured by General Metals Work, Inc., Village of Cleves, Ohio), or equivalent. The samplers will be operated in accordance with EPA Region 7 SOP No. 2314.1A and No. 2314.2A except where procedures differ from this QAPP. In all cases, the policies described in this QAPP shall take precedence over other EPA SOPs. Each sampler will be positioned on the ground level. Suitable supporting structures meeting all local and Federal safety codes will be used. Samplers will be operated

continuously for a 24-hour ($\pm 10\%$) sampling duration. Sampler start and completion times will be referenced to 2400 hours.

Air samples may be voided by the EPA OSC or START Project Manager under the following conditions:

(1) If the sampling duration is outside the 21.6 to 26.4 hour limit; (2) evidence of sample tampering is observed; or (3) sample is known to be unrepresentative (due to contamination, sampler failure, etc.).

One meteorological station will be established for the air monitoring. The station will be sited and operated in accordance with "Quality Assurance Handbook for Air Pollution Measurement Systems: Volume IV Meteorological Measurements", EPA-600/4-82-060, August 1989. Specifically, the station will measure wind direction, wind speed, and temperature from a height of 10 meters. Data logging will be accomplished electronically using an averaging time of 1 hour. Surface pressure (not corrected to sea level) will be recorded hourly. If larger scale meteorological data are required, such "synoptic" data will be acquired from the nearest US Geological Survey stream recording station or from the nearest reporting airport.

Disposal of investigation-derived wastes (IDW) and procedures for equipment/personal decontamination will be addressed in a site-specific health and safety plan prepared by the Tetra Tech START. In general, it is anticipated that most IDW will consist of disposable sampling supplies (gloves, paper towels, etc.) that will be disposed of off-site as uncontaminated debris.

2.3 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

Samples will be collected in accordance with procedures defined in Region VII EPA SOP 2130.4B. Chain of custody procedures will be maintained as directed by Region VII EPA SOP 2130.2A. Samples will be accepted by the contracted laboratory according to their specific procedures and SOPs.

All soil sample containers will be placed in plastic bags to control spillage in case the containers break during shipment. Soil and dust samples will be placed in coolers containing packing material and enough ice to ensure that the temperature of the samples does not exceed 4 C. Necessary paperwork for all samples, including chain of custody records, will be completed by the Tetra Tech START and

maintained with the coolers until delivery to the laboratory. If shipment of the samples is required via commercial service, each cooler lid will be securely taped shut, and two custody seals will be signed/dated and placed across the lid opening. The samples will be submitted to the receiving laboratory by START personnel in a time-efficient manner to ensure that the applicable holding times are not exceeded.

2.4 ANALYTICAL METHODS REQUIREMENTS

The samples will be analyzed at a pre-qualified laboratory contracted by the Tetra Tech START, according to the EPA methods listed in the following table. Detection limits that are typically reported by those methods are expected to be adequate for this activity. The requested analyses have been selected based on past sampling data and historical information collected for the site:

ANALYTICAL METHODS	
Analytical Parameter ¹	EPA Method Number
SOIL/DUST	
Lead, cadmium, arsenic, zinc, nickel	SW846 Method 6010B
AIR	
Lead, cadmium, arsenic, zinc, nickel	SW846 Method 6010 B and 7000 Series

¹ EPA may cease the analysis for zinc and nickel content if zinc and nickel concentrations in the initial confirmation samples are consistently below MDNR's Any Use Soil Levels.

2.5 QUALITY CONTROL REQUIREMENTS

Because dedicated supplies will be used for all samples (i.e., stainless steel spoons, pie pans, etc.), no QC samples will be required to assess the potential for cross-contamination. Analytical error (precision and accuracy) will be determined by the analysis of laboratory-prepared duplicates and spike samples. These criteria, along with other laboratory QC elements, will be performed in accordance with the contract laboratory's quality assurance plan.

To satisfy the quality control elements for the XRF, data will be collected and analyzed for comparability to laboratory data, to determine detection and quantitation limits, and to determine accuracy and precision. The mean of the three XRF readings taken for each confirmation sample will be compared

statistically to the laboratory results for each confirmation sample to assess comparability. The measure of agreement (r^2) for the XRF unit should be above 0.7 or greater for the XRF data to be considered screening level data.

For every measurement, the Niton™ gives an uncertainty range that represents a 95 percent confidence interval. In general, precision/accuracy increases with increasing sample run time. Due to preliminary sample results indicating high lead levels, XRF sample run time will be increased accordingly to improve precision and accuracy. The goal is for samples to be screened long enough to obtain precision measurements within 20% of the actual concentrations.

2.6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS

Testing, inspection, and maintenance of all sampling equipment and supplies, along with field screening instrumentation, will be performed by START personnel prior to deployment for field activities. Testing, inspection, and maintenance of analytical instrumentation will be performed in accordance with the contracted laboratory's analytical SOPs and manufacturers' recommendations.

2.7 INSTRUMENT CALIBRATION AND FREQUENCY

Calibration of the field screening and laboratory analytical instrumentation will be in accordance with the referenced SOPs and manufacturers' recommendations.

2.8 INSPECTION/ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND CONSUMABLES

All sample containers will meet EPA criteria for cleaning procedures required for low-level chemical analysis. Sample containers will have Level II certifications provided by the manufacturer in accordance with pre-cleaning criteria established by EPA in *Specifications and Guidelines for Obtaining Contaminant-Free Sample Containers*. The certificates of cleanliness will be maintained in the project file.

2.9 DATA ACQUISITION REQUIREMENTS

Previous data/information pertaining to the site (including other analytical data, reports, photos, maps, etc., which are referenced in this QAPP) have been compiled by START from various sources. Some of that data has not been verified; however, that information will not be used for decision-making purposes without verification of its authenticity.

2.10 DATA MANAGEMENT

All laboratory data will be managed as specified in the contract laboratory's QAM. Preliminary data will be received by the project manager on site. The final data package will be forwarded to a chemist trained in data validation to complete the validation process. The results will be summarized and included in the report submitted to EPA.

3.0 ASSESSMENT/OVERSIGHT

3.1 ASSESSMENTS AND RESPONSE ACTIONS

Assessment and response actions pertaining to analytical phases of the project are addressed in the contracted laboratory's quality assurance manual(s). Because of the short duration of this sampling event, no field audits of sampling procedures will be performed. Corrective actions will be taken at the discretion of the EPA Project Manager, whenever there appears to be problems that could adversely affect data quality and/or resulting decisions affecting future response actions pertaining to the site.

3.2 REPORTS TO MANAGEMENT

A letter report describing the sampling techniques, locations, problems encountered (with resolutions to those problems), and interpretation of analytical results will be prepared by START, following completion of the field activities described herein and validation of laboratory data. The laboratory data for soil samples will be compared to all applicable or relevant and appropriate requirements (ARARs), including removal action levels that have been established for the site, to determine whether further response is warranted.

4.0 DATA VALIDATION AND USABILITY

4.1 DATA REVIEW, VALIDATION, AND VERIFICATION REQUIREMENTS

Data review and verification will be performed by a qualified laboratory analyst and the laboratory's section manager in accordance with the contracted lab's quality assurance program. Follow-up validation of the data will be performed by a Tetra Tech START chemist. The START Project Manager will be responsible for overall validation and final approval of the data, in accordance with the projected use of the results.

4.2 VALIDATION AND VERIFICATION METHODS

A qualified Tetra Tech START chemist will review the data for laboratory spikes/duplicates and laboratory blanks to ensure that they are acceptable. The START Project Manager will inspect the data to provide a final review. The START Project Manager will also compare the sample descriptions with the field sheets for consistency and will ensure that any anomalies in the data are appropriately documented.

4.3 RECONCILIATION WITH USER REQUIREMENTS

If data quality indicators do not meet the project's requirements as outlined in this QAPP, the data may be discarded, and re-sampling and/or re-analysis may be required.

ATTACHMENT A

Figure 1: Site Location Map

(One page)



Not to Scale

Herculaneum Lead Smelter
Herculaneum, Missouri

Figure 1
Site Location Map



Tetra Tech EM Inc.

Date: 9/10/01

Drawn By: Colin Willis

Project No: G9011.L01.0027.00

ATTACHMENT B

Figure 2: Aerial Photography

(One page)



Not to Scale

Herculanum Lead Smelter
Herculanum, Missouri

Figure 2
Aerial Photography



Tetra Tech EM Inc.

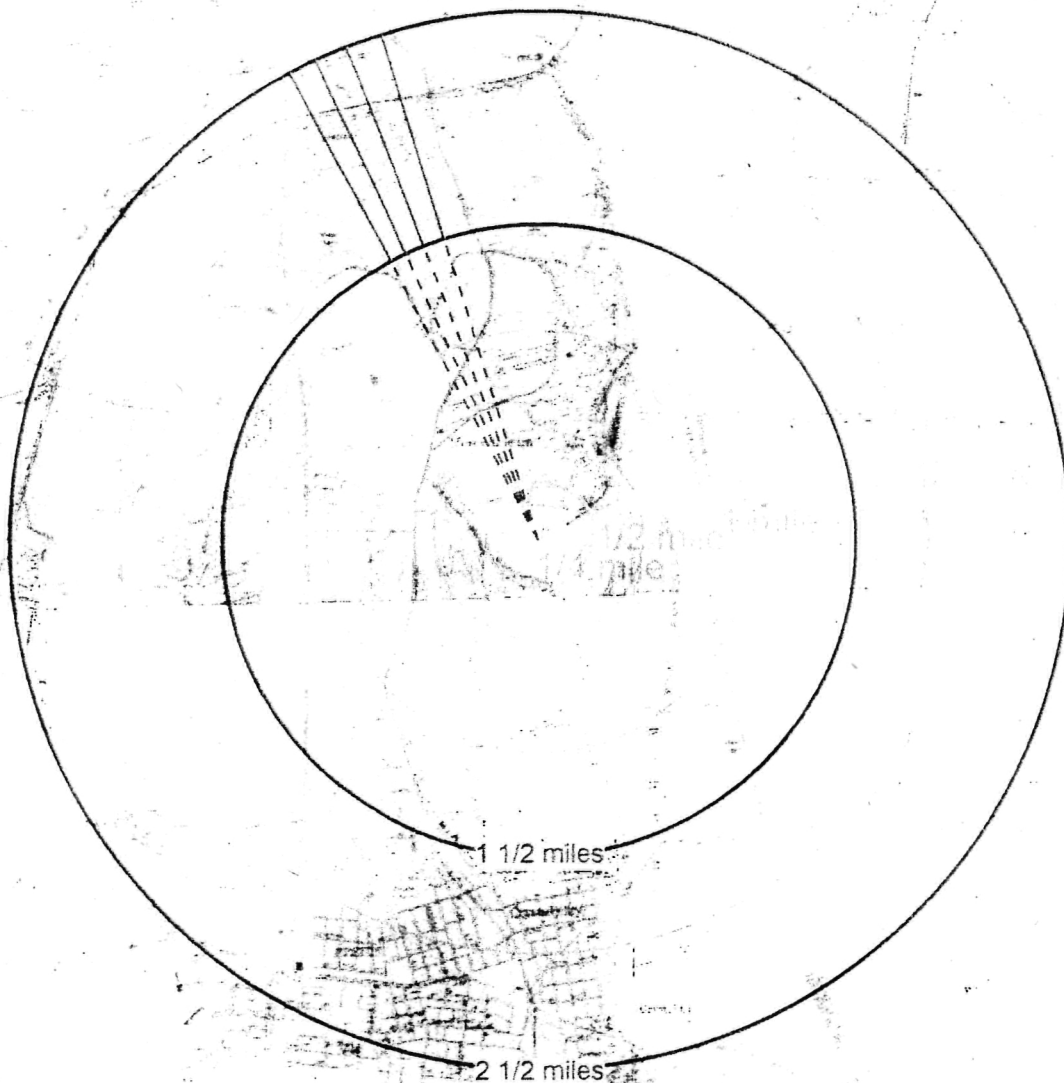
Source: USGS Aerial Photo & CARES Internet Map Server,
University of Missouri-Columbia

Date: 9/10/01




Drawn By: Colin Willis

Project No: G9011.L.01.0027.00

ATTACHMENT C
Figure 3: Sampling Map
(One page)



Legend

-  Radius rings
-  Transect lines
-  Transect lines where sampling will occur



Not to Scale

Note: Samples will be taken every 200 hundred feet along the transect lines between the 1 1/2 miles radius ring and the 2 1/2 miles radius ring.

Source: USGS Festus, MO 7.5 Minute Topo Quad

Herculaneum Lead Smelter
Herculaneum, Missouri

Figure 3 Sampling Map



Tetra Tech EM Inc.

Date: 9/10/01

Drawn By: Colin Willis

Project No: G9011.L 01.0027.00

ADDENDUM TO THE QUALITY ASSURANCE PROJECT PLAN (QAPP)
FOR THE HERCULANEUM LEAD SMELTER SITE
HERCULANEUM, MISSOURI
Task Order No. 0027

This document serves as an addendum to the Quality Assurance Project Plan (QAPP) for the Herculaneum Lead Smelter (HLS) site, where removal activities are currently being conducted at residential properties within the City of Herculaneum. Removal activities outside each home involve the excavation of lead-contaminated soil, the placement of clean backfill, and the re-seeding of grass at the property. Following these outdoor activities, the abatement of lead-contaminated dust inside the home is being initiated. This QAPP addendum addresses screening/sampling of home interiors at which removal activities have already taken place to assess the potential for recontamination due to on-going operations at the HLS site. The data generated during this sampling program will also be used by EPA to evaluate the need for additional measures/procedures to be taken during the abatement of lead-contaminated dust inside the homes.

Tetra Tech START is currently monitoring the concentrations of lead within backfill soil at 10 residences where outdoor removal activities have been completed. This monitoring is being conducted on a monthly basis to evaluate the extent of recontamination of those properties. The initial (baseline) sampling event occurred in February 2002. Tetra Tech START is performing a statistical study of the data generated during this baseline sampling event to determine a statistically representative number of residence interiors to be sampled. This study will be performed in accordance with the guidelines established in the following documents: *Guidance for Data Quality Assessment: Practical Methods for Data Analysis*, EPA QA/G-9, QA00 Version (EPA 2000) and *Statistical Methods for Evaluating the Attainment of Cleanup Standards* (EPA 1989). The variability of the data generated during the baseline sampling event will be used to establish the number of residences to be sampled. It is anticipated that the sampling of 15 to 20 residences will generate a data set that is statistically representative of the area with a level of confidence of 90 percent.

The interior of each residence will be sampled on a monthly basis. At this time, the duration of this sampling program has not been determined, although it is anticipated to last about 12 months. All residences with children with known elevated blood levels for lead will be sampled. Selecting the remaining residences to be sampled will be based on the following criteria: 1) residences with children

under 6 years of age; 2) statistical representativeness of the area to address the recontamination issue; and 3) access granted by the homeowner(s). Wipe and dust samples are to be collected from each residence on a monthly basis. The initial sampling event will also include screening for lead-based paint (LBP) at each residence and the collection of wipe and dust samples from the personal vehicles of five homeowners. Also, carpet samples will be collected from five residences and submitted to the contracted laboratory for analysis. The sampling protocols are presented in the following sections.

Wipe Samples

Five wipe samples will be collected from non-porous surfaces in each residence during each sampling event. The sampling locations will typically include three floors and two window sills within the home. If young children are present in the home, every effort will be made to collect samples from common areas used by the children and from the children's bedroom(s). Templates of known area (1 square foot [sq ft] for floors and 0.25 sq ft for window sills) will be used during sampling to assure the representativeness of the data collected.

As previously stated, wipe samples will also be collected from the personal vehicles of five homeowners. A 0.25-sq ft template will be used to collect a wipe sample from the dashboard of each automobile.

The sampling procedure for wipe samples will follow the guidelines set forth in the *EPA Residential Sampling for Lead: Protocols for Dust and Soil Sampling - Final Report* (EPA 1995). All wipe samples will be submitted to the laboratory for analysis of arsenic, cadmium, lead, nickel, and zinc by EPA Method 6020. Contaminant levels will be expressed in micrograms per sq ft ($\mu\text{g}/\text{ft}^2$), which will represent the contaminant loading at each sampling location. The anticipated number of field samples, quality control (QC) samples, and method of analysis are summarized in Table 1.

Dust Samples

One dust sample will be collected and submitted for analysis from a carpeted floor in each residence during each sampling event. A vacuum cleaner equipped with a high efficiency particulate air (HEPA) filter will be used to collect a dust sample from a high-traffic area in each residence. A template (1 sq ft) will be used at each sampling location to assure the representativeness of the data collected. If sufficient sample volume is not collected from the sampling area, additional material will be collected from an adjacent area of the same size.

As stated above, dust samples will also be collected from the personal vehicles of five homeowners. Each sample will be collected from the driver-side floorboard. If a non-porous (e.g., rubber or vinyl) floormat is present, the sample will be collected from the carpeting adjacent to the floormat. If an upholstered floormat is present, the sample will be collected from the floormat itself.

The dust samples will be collected according to general procedures described in Region 7 SOP 4231.11A (modified to incorporate the use of a HEPA vacuum). Samples will be submitted to the laboratory for the analysis of arsenic, cadmium, lead, nickel, and zinc by EPA Method 6020. The contaminant levels will be expressed in micrograms per kilogram ($\mu\text{g}/\text{kg}$), which will represent the total concentration of each contaminant, and $\mu\text{g}/\text{ft}^2$, which will represent the contaminant loading at each sampling location. The anticipated number of field samples and method of analysis are summarized in Table 1.

Lead-Based Paint Screening

During the initial sampling event, screening of potential LBP surfaces inside each residence will be conducted. This screening will be performed in each room of the residence and will follow the protocol established in U.S. Department of Housing and Urban Development (HUD) *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing* (HUD 1997). An x-ray fluorescence spectrometer will be used to collect the readings from each painted surface. For QC purposes, duplicate readings will be collected at a frequency of 10 percent.

Carpet Samples

After a review of the dust sampling data generated during the initial sampling event, carpet samples will be collected from five residences. Upon approval from the homeowner, a 1-square-inch sample of carpet will be removed from a high-traffic area and a low-traffic area within each residence. New carpet will be installed by an independent contractor after the collection of these samples. In order to limit the area requiring new carpeting, sampling locations will be selected in smaller areas/rooms within each residence, such as a hallway or child's bedroom. The old carpeting will be removed and the underlayment cleaned by a licensed lead abatement contractor prior to the installation of the new carpeting. The carpet samples will be submitted to the laboratory for analysis of arsenic, cadmium, lead, nickel, and zinc by EPA Method 6020. The number of field samples and method of analysis are summarized in Table 1.

Table 1
Samples Submitted for Laboratory Analysis
Interior Recontamination Sampling at the Herculanum Lead Smelter Site
Herculanum, Missouri

Field Sample	Quantity of Samples	Quality Control Samples and Frequency	Analytical Method and Units of Data
Wipe Samples			
Residences	1200 ¹	Field Blanks ² - 5%	EPA 6020 - micrograms per square foot ($\mu\text{g}/\text{ft}^2$)
Personal Vehicles	5	N/A	EPA 6020 - $\mu\text{g}/\text{ft}^2$
Dust Samples			
Residences	240 ³	Equipment Blank ⁴ - 1	EPA 6020 - $\mu\text{g}/\text{ft}^2$ and micrograms per kilogram ($\mu\text{g}/\text{kg}$)
Personal Vehicles	5	N/A	EPA 6020 - $\mu\text{g}/\text{ft}^2$ and $\mu\text{g}/\text{kg}$
Carpet Samples			
Residences	10	N/A	EPA 6020 - $\mu\text{g}/\text{ft}^2$ and $\mu\text{g}/\text{kg}$

NOTES

1. Sample quantity is based on 5 samples/residence x 20 residences sampled x 12 sampling events.
2. Field blanks will be collected by inserting a clean, unused wipe into a sample container.
3. Sample quantity is based on 1 sample/residence x 20 residences sampled x 12 sampling events.
4. During the initial sampling event, a clean, unused HEPA filter will be submitted to the laboratory for analysis.

David L. May
for Ryan Schuler, START 2 Project Manager

3/19/02
Date

Ted Faile
Ted Faile, CHMM, START 2 Quality Assurance Manager

3/19/02
Date

Bruce A. Morrison
Bruce Morrison, Region 7 Superfund Division, EPA Project Manager

3/19/02
Date

Robert B. Dona
Bob Dona, Region 7 Superfund Division, Quality Assurance Coordinator

3/20/02
Date

Draft
July 28, 2003
Standard Operating Procedure
For
Road Sampling
At the
Herculaneum Lead Smelter Site, Herculaneum, MO

Equipment Used

HEPA Vacuum VACOMEGA
Dust Collection Sample Filter
Inlet Nozzle 1.245" x 4"
Power Inverter 1000/2000 Watt
24 feet of Battery Wire Cable
Vehicle and Battery to Supply Power

Model # 950-AI-00-120
Part No. FAB-07-03-006PS
Part No. 924-MV-18-004N

6 gauge

Setup

1. Equipment is gathered and the vehicle is prepared for sampling.
2. The 24 foot Battery Wire Cable is connected to the vehicle battery, run over the top of the vehicle and through the rear driver side window.
3. The Battery Wire Cable is connected to the Power Inverter.
4. The VACOMEGA's power is turned on to assure that the vacuum is functioning properly.

Filter Preparation

At each sampling location, one new pre-weighed Dust Collection Sample Filter and Inlet Nozzle are used. At the open end of the vacuum hose, a filter is folded and inserted into the open end of the vacuum hose. The blue sides of the filter are rolled down so the paper portion of the filter is even with the top hose. The inlet nozzle is then inserted over the end of the vacuum hose to secure the filter.

Sample Location

At each known sampling location, the vehicle is parked facing the direction of oncoming traffic and the vehicle remains running while the sample is taken. With the known recorded filter loaded in the vacuum hose the vacuum is switched on to collect the sample. The 3 feet by 3 feet sample area is then vacuumed one time over to pick up all road dust that has settled in the sample area. At the end of the sampling, the vacuum nozzle is turned upright (so the filter is turned upright) and the power is turned off. The inlet nozzle is taken off and the filter is pulled out of the vacuum hose. The filter is then rolled up and placed into its properly labeled sample container.

This procedure is completed at each sampling location. At the end of each sampling event, samples are recorded in the sample management book, labeled, and chains of custody are completed for shipment to the laboratory

At the Laboratory, EPA SW-846 Method 3050B is used in the digestion process. Analysis is completed by inductively coupled argon plasma spectrometry - mass spectrometry (ICP-MS) using EPA SW-846 Method 6020A. The units reported by the laboratory are in milligrams per kilogram (ppm), and since the hepa filters are pre-weighed, units are also reported in milligrams per square foot.




UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VII
901 NORTH 5TH STREET
KANSAS CITY, KANSAS 66101

MAY 09 2007

MEMORANDUM

SUBJECT: Addendum to the Quality Assurance Project Plan (QAPP) for Site Characterization for the Herculaneum Lead Smelter Superfund Site

FROM: Bruce A. Morrison, RPM 
SUPR/FFSE

TO: EPA Quality Assurance Branch

This Memorandum is intended to supersede the previous addendum approved on September 5, 2006.

At the Herculaneum Lead Smelter Superfund Site surface soil samples are collected in accordance with the September 10, 2001, Quality Assurance Project Plan which states that samples are to "be collected from the upper 1 inch of soil". In practice, since the inception of the 2001 QAPP, EPA's samples are collected from the upper portion of the 1 inch soil horizon so as to ensure that a depth of 1 inch is not exceeded because exact measuring devices are not used when collecting sample aliquots.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VII
901 NORTH 5TH STREET
KANSAS CITY, KANSAS 66101

JUL 23 2007

MEMORANDUM

SUBJECT: Addendum to the Quality Assurance Project Plan for Site Characterization for the Herculaneum Lead Smelter Superfund Site – Approved with Comment

FROM: *for* Diane Harris 
Regional Quality Assurance Manager
ENSV/IO

TO: Bruce Morrison
EPA Project Manager
SUPR/FFSE

The review of the subject document has been completed according to "EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations," EPA QA/R-5 March 2001.

Based on the comments below, the document, in conjunction with the previously approved QAPP dated September 10, 2001, is approved with comment. Although the document satisfactorily addresses the key elements, minor issues were noted. These issues do not have an impact on the approval of the document, but are noteworthy of pointing out for the record. Because this is an addendum without a separate signature page, this memo will suffice for QA approval of the addendum.

General Comments

1. SOP 4231.11A should now be referenced as ERT SOP #2011. An electronic copy can be obtained through the R7 intranet or at <http://www.ert.org/products/2011.PDF>.
2. The fourth paragraph states analysis for Cd, Zn, As, and Ni can be discontinued for the dust samples. It would be useful to state why these analyses can be discontinued (e.g., previous data shows no contamination above the action levels, enough data has been collected for these contaminants to meet project objectives, etc.).

If you have any questions, please contact me at x7258.

R7QAO Document Number: 2007195

MEMORANDUM

SUBJECT: Addendum to the Quality Assurance Project Plan for Site Characterization
for the Herculaneum Lead Smelter Superfund Site

FROM: Bruce A. Morrison
Project Manager

TO: EPA Quality Assurance Branch

Cross reference SOP 4231.11A to current SOP.

The current soil sampling Standard Operating Procedure (SOP) for the Site does not describe the procedure for taking 3 XRF readings of each soil sample and the averaging performed to reach a single measurement for lead concentration in the sample. The following is a description of this procedure.

After the surface soil sample is homogenized, three separate readings are to be taken with the XRF. If there is a difference greater than 10 percent between the three XRF readings, they are to be discarded, the sample is to be re-homogenized, and three new XRF readings are to be taken. This procedure is to be followed until three XRF readings are taken that are within 10 percent of each other. Following the attainment of three XRF readings that are within 10 percent of each other, the mean of the three XRF readings should be calculated and reported as the final lead concentration for the sample. For non-detect readings, the detection limit value read on the instrument should be used as the value for the lead concentration. Although this will provide a high-biased mean for the sample, it should not result in the need for cleanup action, as non-detect readings should be well below the site action level for lead in soil. In addition, this interpretation of non-detect data is consistent with previous data handling and will allow for continuation of statistical analysis for soil lead trends.

One-inch carpet samples are not to be collected from home interiors. It was determined that there was too much interference from other carpet compounds to effectively extract and measure lead levels.

Dust samples are to only be analyzed for lead. Analysis for cadmium, zinc, arsenic, and nickel can be discontinued.

For the collection of a vacuum dust sample, the HEPA Vacuum, VACOMEGA - Model number 950-AI-00-120, or equivalent, should be used. The 1 square foot area of the carpet should be vacuumed for approximately 5 minutes per sampling event. The entire area should be well agitated to obtain the most dust as possible. Each vacuum filter should be pre-weighed to 4 decimal places.

2007195
RECEIVED
JUL 23 2007

MEMORANDUM

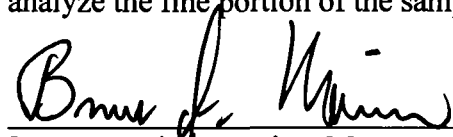
SUBJECT: Addendum to the Quality Assurance Project Plan for Site Characterization
for the Herculaneum Lead Smelter Superfund Site

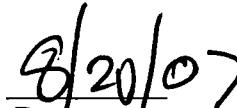
FROM: Bruce A. Morrison
Project Manager

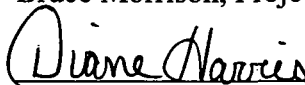
TO: EPA Quality Assurance Branch

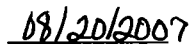
At the Herculaneum Lead Smelter Superfund Site, soil samples were previously collected into bags. Soil samples were homogenized either in the bag or in an aluminum pan depending on the volume and texture. Samples were then analyzed with the XRF without any sample preparation other than homogenization.

Beginning in November 2006, sample preparation prior to analysis was adjusted. After collection, samples are placed into pans and allowed to completely air dry. Once dry, the soil is homogenized and passed through a number 10 sieve. An XRF is then used to analyze the fine portion of the sample.


Bruce Morrison, Project Manager


Date


Diane Harris, Regional Quality Assurance Manager


Date

2007216
RECEIVED

AUG 20 2007